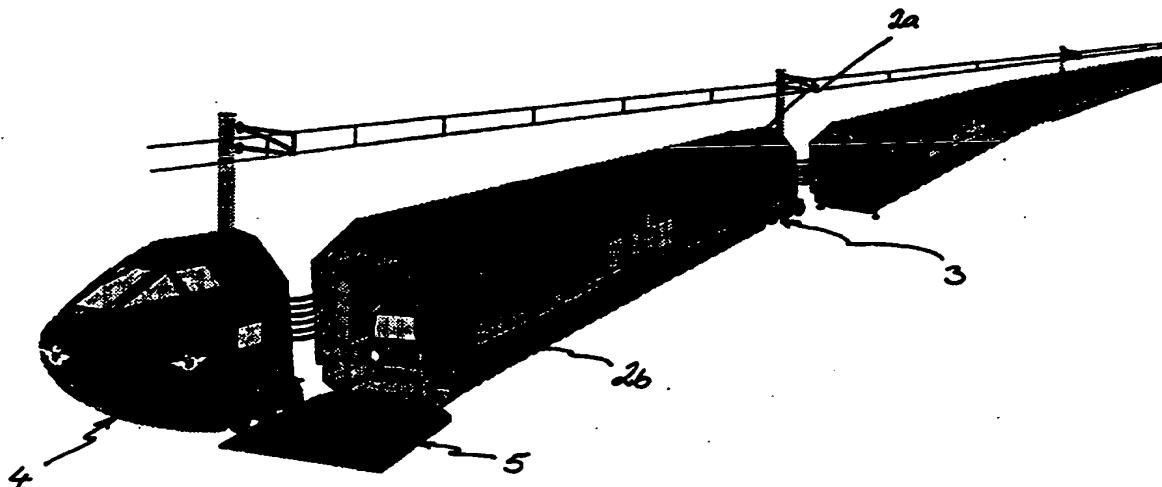


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(54) Title: A METHOD AND DEVICE FOR LOADING AND UNLOADING A GOODS TRAIN**(57) Abstract**

Method and arrangement for roll-on/roll-off loading and unloading respectively of goods train sets, which mainly are intended for high speed transport of complete vehicles or vehicle trains as well as load carrying platforms and/or containers. By turning a load carrying portion (2b) from its normal position in the length direction of the train set to which it belongs, loading and unloading is made possible in that the load carrying portion (2b) is turned around a vertical shaft coupling (18) of turntable type at one end portion of the wagon by the use of an entrance and exit ramp (5) in a carry and drive arrangement (23), whereafter the goods is loaded/unloaded with its ordinary load carrier by the use of the entrance ramp.

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A method and device for loading and
unloading a goods train

5 The present invention relates to a method and an
arrangement for loading and unloading goods train sets
having several goods carriers, which goods trains mainly
are intended for high speed transport of complete vehicles
and vehicle trains as well as load carrying platforms
10 and/or containers.

Trains for transport of people as well as goods are
today considered to have and will not the least in the
future get a more and more outstanding position regarding
above all an environmental, economical view-point on long
15 distance transports. In the future it will be more evident
than before that it is necessary to economize all possible
resources. In order to achieve this, it will be necessary
to transfer long distance transport of goods from the roads
to trains, and for this purpose many technical solutions
20 have been proposed. None of these has however been such
that it has given train transport of goods the ability to
compete on reasonably the same conditions as present
systems and arrangements for handling of loads, above all
road transports. Most systems aiming to rationalize and to
25 transfer heavy transport from the roads to the railroads
have as a consequence of that they have been uneconomical
or too technically complex not had the possibility to break
through as an alternative. This has also implied that no
economical incentives for a transfer from road to train
30 transports have been present. As an example of an
uneconomical solution the system described in US-A-
4 425 064 may be mentioned, in which a loading and
unloading system for a railway car is described. The system
described herein implies to the positive that
35 lorries/trailers are admitted all the way to the railway
car and consequently can transport the loads all the way to

the wagon. According to the suggested solution, however, firstly all lorries to be transported in this fashion must be trailers, and secondly the transport company must make extensive infra structure investments in order to realize the concept, since the load and unload area will be very large. From what can be seen t a visual inspection a synergetic look is furthermore lacking, which makes it possible to transport both lorries and cars possibly also combined with caravans and of course also load carrying platforms and containers, and secondly that railroad transport as such, but also to perform loading and unloading as quick as possible. The speed of the transport itself will shortly become a demand, on the one hand because the disturbing effect that the more slowly running trains gives on the other train traffic is not acceptable in the longer run, and on the other hand in order to reach a better transport efficiency, competing with road transports. The total efficiency for long distance transports will thereby on the whole become much better with train than with trailer or lorry.

The object with the present invention is consequently to accomplish a method for transport, loading and unloading of goods trains intended for unit loads which gives such a simple, quick and efficient handling and transport of the goods, that it can compete in a meaningful way with road transport which today is dominating. This object means on the one hand that the goods is to be loaded and unloaded according to the roll on-roll off method, and on the other hand that it is to be done without using different kinds of cranes or marshalling of the goods.

Another object is to accomplish a method which makes it possible and above all in an unproblematic way allows loading and unloading of separate unit goods on a certain station along a predetermined route where the said station is not the end station for the train set as such.

Yet another object is to accomplish a method which makes it possible to efficiently handle goods without implying extensive investments in infra structure.

5 Last but not least it is an object with the present invention to accomplish an arrangement for realizing the method above.

According to the invention, loading and unloading of a goods wagon is done in that a load carrying part belonging thereto is turned from its normal position in the
10 length direction of the train set, in that the load carrying part is turned around a coupling of turntable type around a vertical axle at one of the end portions of the wagon, whereby a transverse section obliquely to the transport direction of the wagon is opened/exposed so that
15 the goods may be loaded/unloaded by means of ordinary load carriers, such as trailers, container carriers, load carrying platforms or vehicles on the whole.

A substantial advantage with the invention is that the only substantial investment regarding infra-structure
20 required is that an entrance/exit platform must be arranged on a suitable level such as at the same level as the top of the railroad rail, for the entrance and exit ramp according to the invention. The infra-structure platform needs thereafter only to be connected to the regular road system
25 for the connecting regional transports.

In the following the invention will be described in detail with reference to an embodiment shown on the enclosed drawings, in which:

Figs. 1a and 1b schematically show a complete train
30 set on the one hand in transport position (1a) and on the other hand in a loading/unloading position (1b),

Fig. 2a partly in section shows an entrance and exit ramp in the transport direction of the train,

Fig. 2b shows the same ramp as in Fig 2a but with a
35 drive and carry arrangement in an inactive position,

Fig. 3 is a view from III-III in Fig. 2a partly as a section,

Fig. 4a is an enlarged view showing the drive and carry arrangement for turning a load carrier of a goods wagon,

Fig. 4b shows a cross section along IVb-IVb in Fig. 4a,

Fig. 4c shows a view from IVc-IVc in Fig. 4a,

Fig. 5a shows an alternative design of the drive and carry arrangement according to Fig. 4a,

Fig. 5b shows a cross section from Vb-Vb in Fig. 5a,

Fig. 5c shows a view from Vc-Vc in Fig. 5a,

Fig. 6 shows a goods wagon load carrier arranged on a wheel bogie from the side,

Fig. 7 is a view of a goods wagon load carrier in a loading/unloading position, i.e. turned out position,

Fig. 8 is a schematical top view of a goods wagon load carrier without an entrance/exit ramp, arranged on a bogie, which is common for two load carriers,

Fig. 9 is a view which is analogous to Fig. 8 except that the load carrier is shown in its turned out loading/unloading position,

Fig. 10 shows a cross section through a load carrier basket according to the invention,

Fig. 11 shows a cross section analogous to Fig. 10 of a load carrier basket with roll front walls,

Fig. 12a shows an alternative design of the turning arrangement in an inactive position for a load carrier as above, and

Fig. 12b shows the turning arrangement according to Fig. 12a in an active position with a turned wagon.

As can be seen from the diagrammatical Figs. 1a and b, it is according to the invention suggested a method which with arrangements to realize the method makes high speed, so called ro-ro-transport of road vehicles and unit

goods possible. In its present form the concept is based on the already commercially running high speed concept for passenger trains, in Sweden called the X2000. The train as such comprises a locomotive 1, common wheel bogies 3, goods carriers 2, which may be turned in and out, a return cockpit 4 to make it possible to drive the train set in any track direction, and at least one entrance and exit ramp 5 for enabling loading and unloading. It appears from the drawings that the train set has an intact set of control lines which follows the movements of each load carrier 2.

Fig. 2a shows in partial cross section the entrance and exit ramp 5 according to Fig. 1. Except for its function to constitute an entrance and exit ramp in its lowered position, the ramp also has the function in its raised position to actively contribute to ensuring that the load carrier 2 can be brought apart along a dividing plan 6 and turned into a position for loading/unloading. The turning/bringing apart is carried out in that a drive and carry arrangement (which in transport position is contained in the entrance and exit ramp and locked therein, which is shown by Fig. 2b) after release and raising of the load carrier (described in detail below) by hydraulic struts is let down on a concrete slab, which is arranged in a level coinciding with the top of the rail, and thereafter again is locked to the ramp 5 with hydraulically controlled lock and carry pins 7. The load carrier 2 is thereafter lowered so that it rests on the drive and carry arrangement. The drive and carry arrangement comprises in this embodiment, which more clearly is shown in Fig. 3 and Figs. 4a-c, on the one hand a large wheel 8 driven by a hydraulic motor (not shown) and on the other hand two smaller support wheels 9 resiliently supported by springs. The support wheels 9 are supposed to enhance the stability of the load carrier during the turning operation since in this case otherwise only three points of support are present for the

load carrier. The support wheels may in an alternative embodiment (not shown) be placed asymmetrically in order to prevent a too large swaying of the load carrier 2 during its turning for example when rolling over the rail recesses in the concrete slab 10 which is arranged above a conventional rail sleeper 11 and the top surface of which coincides with the top surface of the rails. Fig. 3 shows partly in a cross section a side view of the entrance and exit ramp 5 with the hydraulic cylinder 6, the lock and carry pins 7, the drive wheel 8 and the support wheels 9. The concrete plate and the sleeper 11 are also shown below the support wheel 9.

The geometry for the drive and carry arrangement is diagrammatically shown in Fig 4b, such as that the support wheels 9 are to some extent turned in relation to the drive wheel 8 in order to let the wheel 8 and the wheels 9 roll on radii which all have their center in the pivot point 12 of the load carrier at the other end of the assembled wagon. It also appears in Fig. 4c that the wheels 9 are somewhat turned out of the vertical plane of the drive wheel 8.

An alternative embodiment of the drive and carry arrangement according to the invention is shown in Figs. 5a-c. The drive wheel 8 according to the first embodiment is hereby replaced by four smaller wheels 14, each of which is driven by a hydraulic motor (not shown). A drive transport band 15 of reinforced rubber is arranged around the wheels 14 for the transfer of the movement. In other aspects the solution corresponds to the described with reference to Figs. 2-4, so that also the axes of the wheels 14 intersect in a common pivot point 12, which is the vertical pivot axis of the load carrier 2.

Fig. 6 shows in a partly sectional view a common bogie 3 for two load carriers 2 with a turntable coupling 18 (not shown in detail) and the load carrier 2 arranged

thereon. In the intermediate part of the bogie there is an upright post 16 for carrying cables (especially when turning load carriers 2) which connects the locomotive 1 with the load carrier 2 and the last load carriers 2 to each other and at the end of the train the last carrier 2 with the return cockpit 4. As mentioned above the cables are not supposed to be disconnected unless the set of wagons in the train set is to be changed, since the cables contain everything that the train in its entirety needs for its function, as for example pressurized air, hydraulic oil and so on. It also appears in this figure that the load carrier 2 has slidable roll front walls are stored in the part of the load carrier 2 which during turning remains attached to the turntable coupling 18 of the bogie 3. The precision in the coupling between the fixed part 2a of the load carrier 2 and its turnable part 2b is such that the roll front walls easily can be pushed past the division between the two parts (not shown in detail). The function of the roll front walls 17 is to give the car drivers easy access to their respective vehicles as well as to give a good availability for tightening the goods/cars to the chassi of the load carrier 2b. Yet another function is of course to give the train a fairly even outer surface in order to bring down the air resistance created as far as possible, especially when driving with high velocities.

The appearance of a railroad wagon of the actual kind with its load carrier 2b in a turned out loading and unloading position is schematically shown in Fig. 7. The jacklike hydraulic struts 19, which have been mentioned but not shown, are here distinctively visible. The struts are used both when setting down the drive and carry arrangement from a completely closed transport condition for the load carrier 2b and when loading and unloading the goods to be transported, whereby the total stability of the load carrier is of utmost importance.

Figs. 8 and 9 go together in the sense that they both show a bogie 3 with load carriers 2a and 2b arranged thereon, viewed from above. Fig. 8 shows diagrammatically how it is suitable to fix the load carrier portions 2a and 2b to each other in transport position, preferably at three points which are marked with a capital H in the figure. The supporting part of the load carrier is thereby essentially in its superstructure, i.e. the walls and the roof thereof down to approximately 1.2 meters above the rail top. This means that the width inside the load carrier can be kept as wide as possible in the lower parts in order to make it possible to install different kinds of equipment, such as hydraulically equipped consoles (not shown) movable in the length direction of the load carrier for load fixing and supporting for example load carrying platforms without wheels. The idea is consequently to enable a quick and easy lifting of load carriers and containers from their wheel carriers. Fig. 9 shows moreover ways mentioned above of how to turn the load carrier at the transition to and from the loading/unloading position respectively, above all it appears how small the turning movement is.

Fig. 10 shows in cross section through a load carrier 2a, 2b more exactly where the anchoring points between the load carrier parts 2a and 2b (H) are situated. It is further shown where necessary cables 20 are arranged and connected at 21 and also with shadowed portions where space is available for certain kinds of special equipment.

Fig. 11 shows above all how the roll front walls are journalled. The roll front walls are preferably simply rolled together by means of a motor (not shown) and are stored in the space created in the load carrier portion 2a. Evidently the dividing and turning possibility may as an alternative be arranged at both ends of the load carrier, so that in reality roll-on and roll-off become possible without forcing the vehicles to back off the train.

As can be seen in Fig. 12 it also possible to turn the whole load carrier 2b in order to make loading and unloading from two directions possible. This is possible by arranging drive and carrier devices in both ends of the load carrier 2b and arranging hydraulically controlled carry and turn segments 22 at each side of the intermediate portion of the load carrier, which segments act directly against the concrete slab 10. By a simple hydraulic connection the positive side of the first turn segment hydraulic cylinder is connected via valves (not shown) to the minus side of the other (opposite) turn segment hydraulic cylinder when the load carrier is to be turned out to the loading/unloading position (corresponding to Fig. 12b), whereas the minus sides of the hydraulic cylinders analogously are connected when the load carrier is to be turned back into its original/transport position (corresponding to Fig. 12a). In this way the segments 22 will act as a hub around which load carrier 2b turns when the drive and carry arrangements (Fig. 4a or 5a) puts the load carrier into turning movement. An arrangement with carry and turn segments may of course also be supplemented with drive and carry arrangements 6-9, 14-15 at one or both ends of the load carrier 2b.

The method according to the invention includes the steps and measures in the order given below:

1. All brakes are locked/blocked
2. All spring movements in the wheel bogies are blocked/locked.
3. The turntable couplings 18 are blocked in all directions of movement except for movement around the pivot shaft which is defined transversally to the train through the turntable coupling.
4. The connection locks between the load carrier portions 2a, 2b are released at at least one end of the load carrier 2b.

5. The released part of the load carrier 2b is lifted by means of the struts 19 between 6 and 10 cm from the directing pins and segments which steer and direct the load carrier to the position where it may be locked to the carrier portion 2a during the reverse cycle.

6. The drive and carry arrangement 6-9; 14-15 in the exit and entrance platform 5 is lowered to a working position by means of the hydraulic cylinder unit 6 and is locked there.

10 6b. See 13.

7. The struts 19 are hydraulically pulled up so that the load carrier 2b is lowered to rest on the drive and carry arrangement.

8. The drive arrangement is started and turns out the load carrier into a loading/unloading position.

9. The load carrier 2b is lifted by means of the struts 19 so that the drive arrangement is released.

10. The drive and carry arrangement is lifted by means of the hydraulic cylinder unit 6 up to the entrance and exit platform.

11. The lock and carry pins 7 of the entrance and exit platform are released and the platform is lowered by means of two hydraulic cylinders (not shown).

12. The load carrier is lowered in such a way that the entrance and exit platform 5 lands in the ground level on the concrete slab 10 in its whole length.

13. (Refers to portion 6b. Relates to an alternative embodiment according to Figs. 12a, 12b.) The carry and turn segments are lowered to their work position by pumping oil into the plus side of its hydraulic cylinders. Said plus side constitutes a common circuit for both of the hydraulic cylinders on the plus side which has its correspondence on the minus side. The connections between the plus and minus sides respectively are closed in transport position so that

no doubts may exist regarding whether the arrangement is in work or transport position.

When the carry and drive arrangements on the entrance and exit platforms start to work in order to turn the wagon
5 body, the segments 22 will act as a hub around which the load carrier is turned for loading/unloading or returning to transport position.

CLAIMS

1. Method in roll-on-roll-off loading and unloading respectively, of goods train sets comprising a number of goods carriers, which train sets are intended mainly for
5 high speed transport of complete vehicles/vehicle trains as well as load carrying platforms and/or containers, whereby loading and unloading respectively is done by turning a load carrying portion of the goods carrier from and to its normal position in the length direction of the train set,
10 whereafter the goods is loaded/unloaded by means of an entrance ramp (5) and with the ordinary load carriers, characterized in that the load carrying portion during the turning is divided along horizontal as well as vertical oblique transversal planes (24) through
15 the load carrying portion (2a, 2b) of the goods wagon, whereby the load carrying portion (2a) both when turning in and out is first lifted upwards by struts (19 for lowering at least one drive and carry arrangement (23) by means of a hydraulic cylinder arrangement (6), and thereafter is let
20 down on the drive and carry arrangement (23) which translates the load carrier by turning around a vertical turning axis (12).

2. Method according to claim 1, characterized in that the load carrier (2b) is
25 kept stable against tipping movements in its loading/unloading position by means of the struts (19) together with the entrance and exit ramps (5).

3. Method according to claim 2, characterized in that the load carriers (2a,
30 2b) are entirely locked to each other in transport position.

4. Arrangement for roll-roll-roll-off loading and unloading respectively of goods trains sets, which train sets mainly are intended for high speed transport of a
35 complete vehicle or vehicle trains as well as load carrying

platforms and/or containers, characterized in that it comprises at least one entrance and exit platform (5) which is arranged at one or alternatively both ends of a load carrying portion (2b) on a goods wagon, which
5 platform (5) includes a carry and drive arrangement (23) which is intended to turn the load carrying portion (26) sideways relative to the train set by means of translation.

5. Arrangement according to claim 4, characterized in that the sideways turn of the
10 load carrying portion (2b) is done around a coupling (18) which mainly is identical to a turntable coupling for trailers.

6. Arrangement according to claim 4, characterized in that the turning of the load
15 carrying portion is done by the use of a carry and turn segment arrangement (22) which is arranged in the intermediate portion of the load carrier (2), which arrangement acts directly against a concrete slab (10) at the rail.

20 7. Arrangement according to claim 5 or 6, characterized in that the entrance and exit ramp (5) in its erected position also constitutes a gate for the load carrying portion (2b).

8. Arrangement according to claim 7,
25 characterized in that the load carrier (2b) has internal hydraulically equipped consoles transferable in its longitudinal direction for the locking of load carrying platforms and containers without wheels.

9. Arrangement according to claim 8,
30 characterized in that the sides of the load carrier can be closed by means of roll front walls (17) which may be rolled into the load carrying portions (2a) by means of a motor.

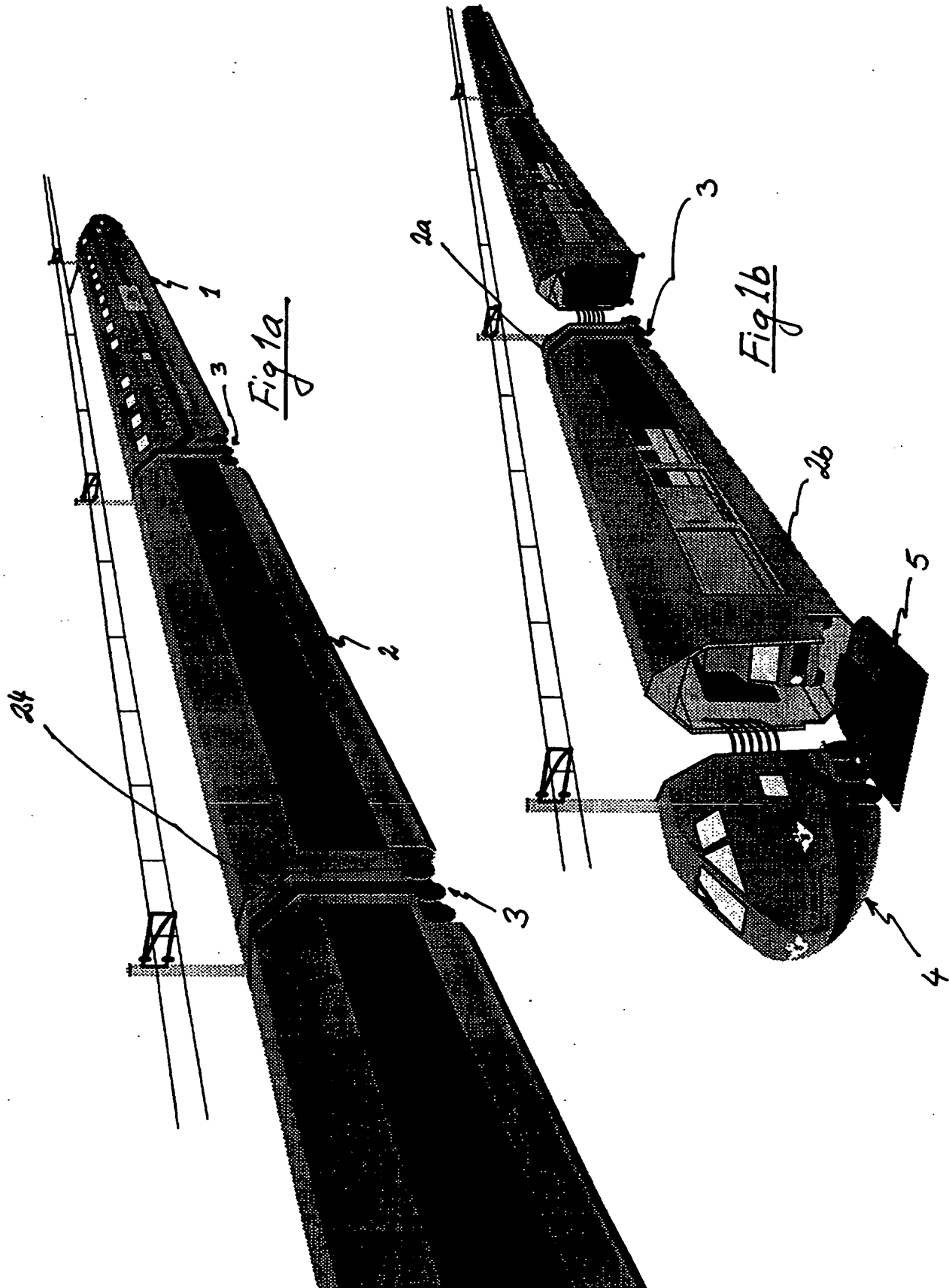


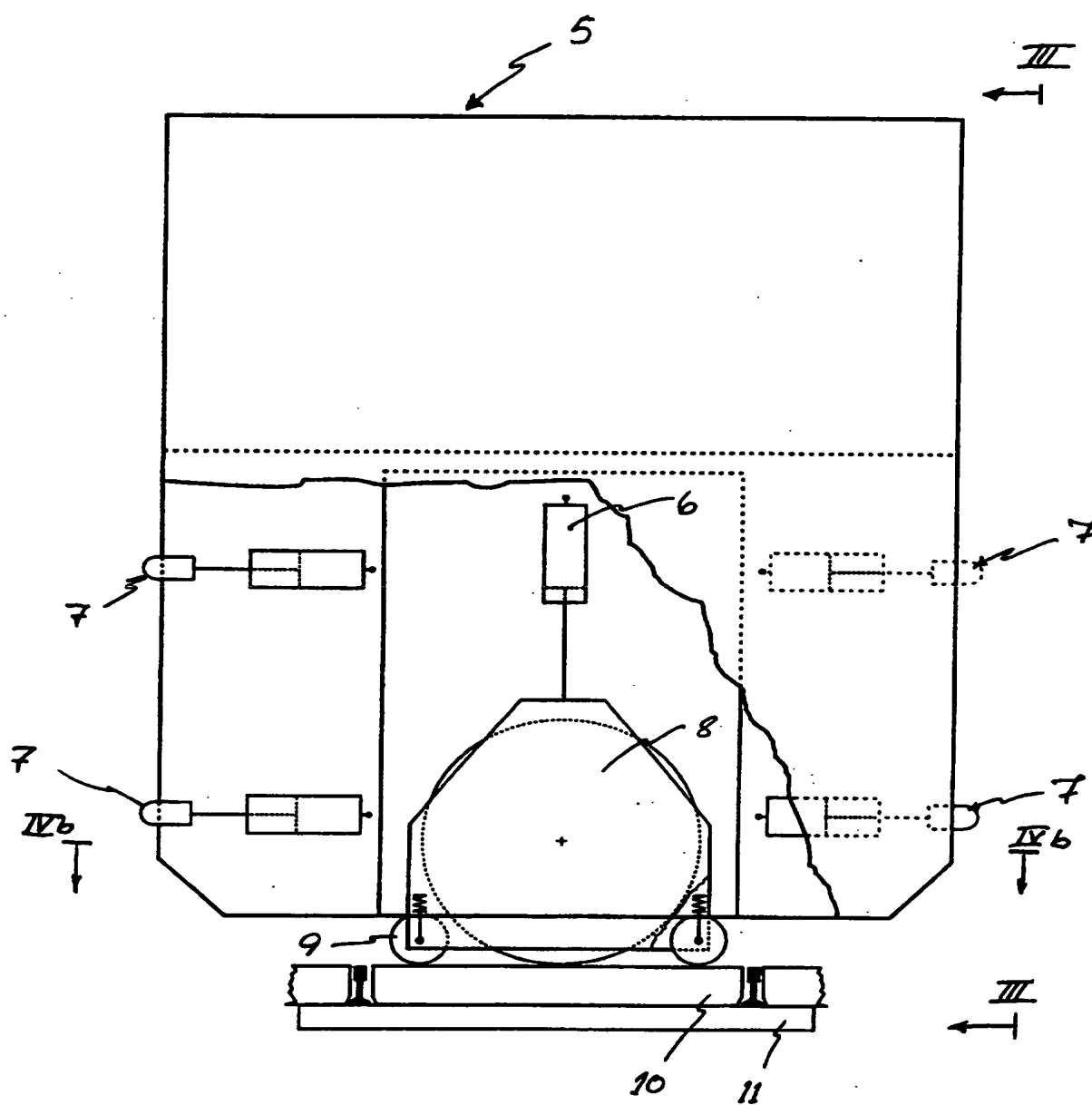
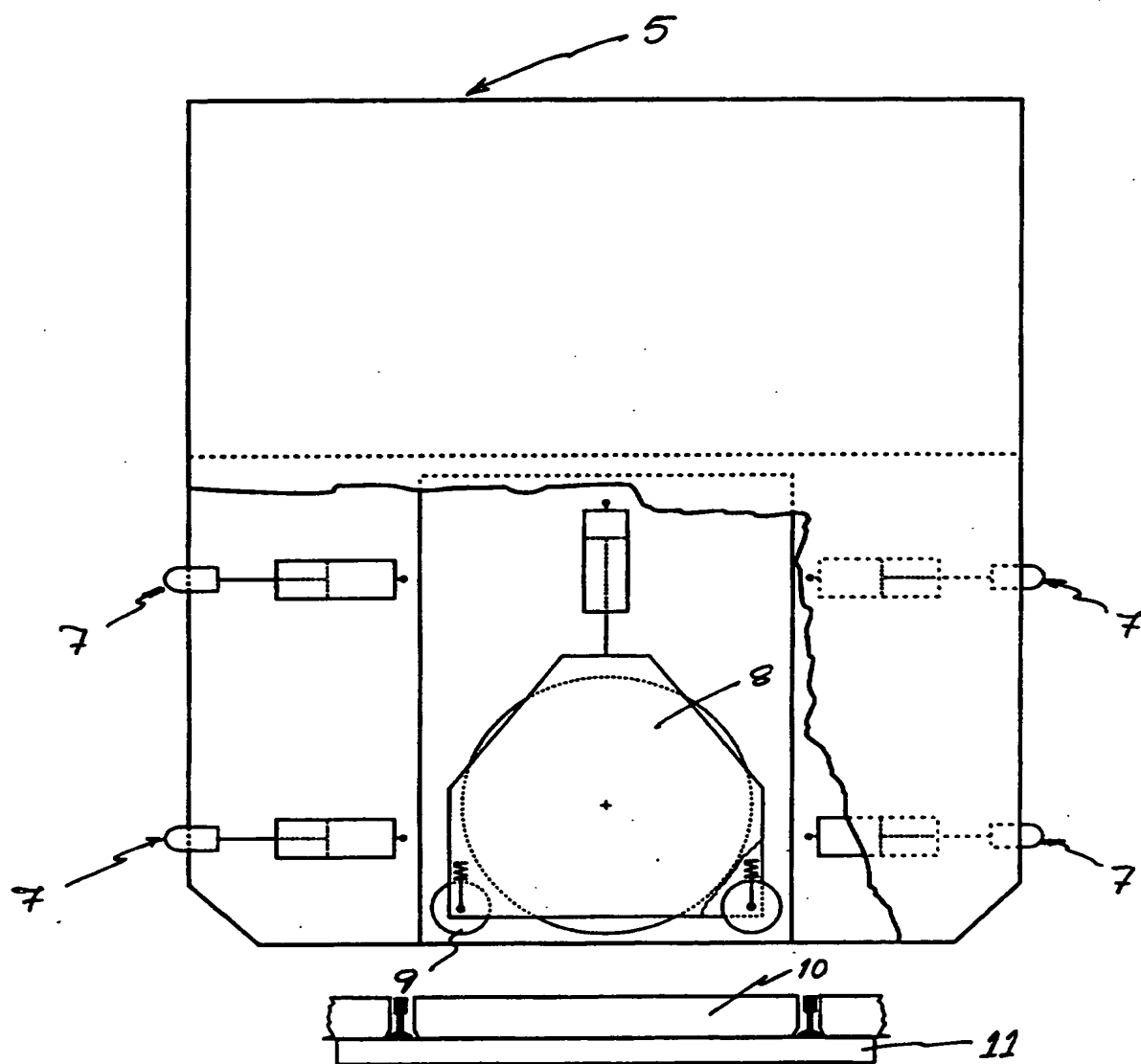
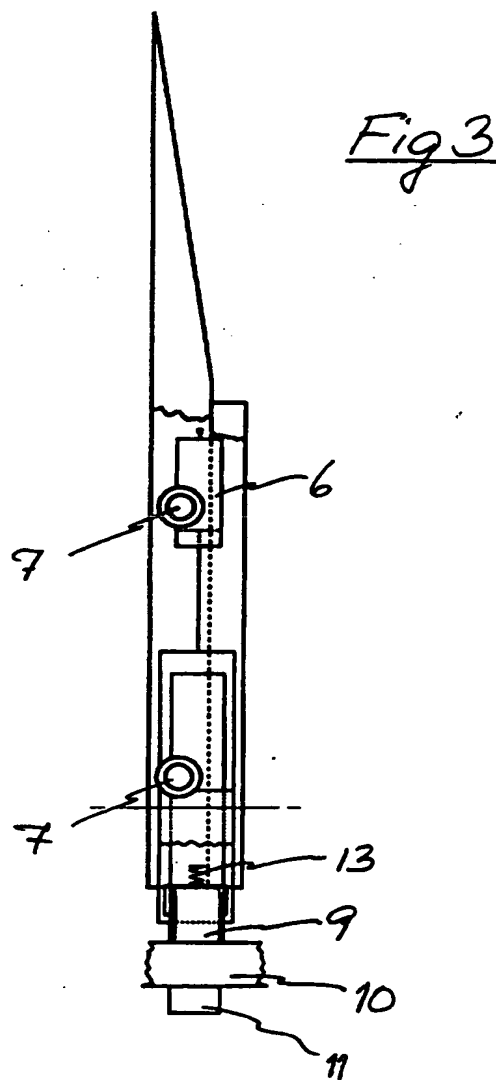
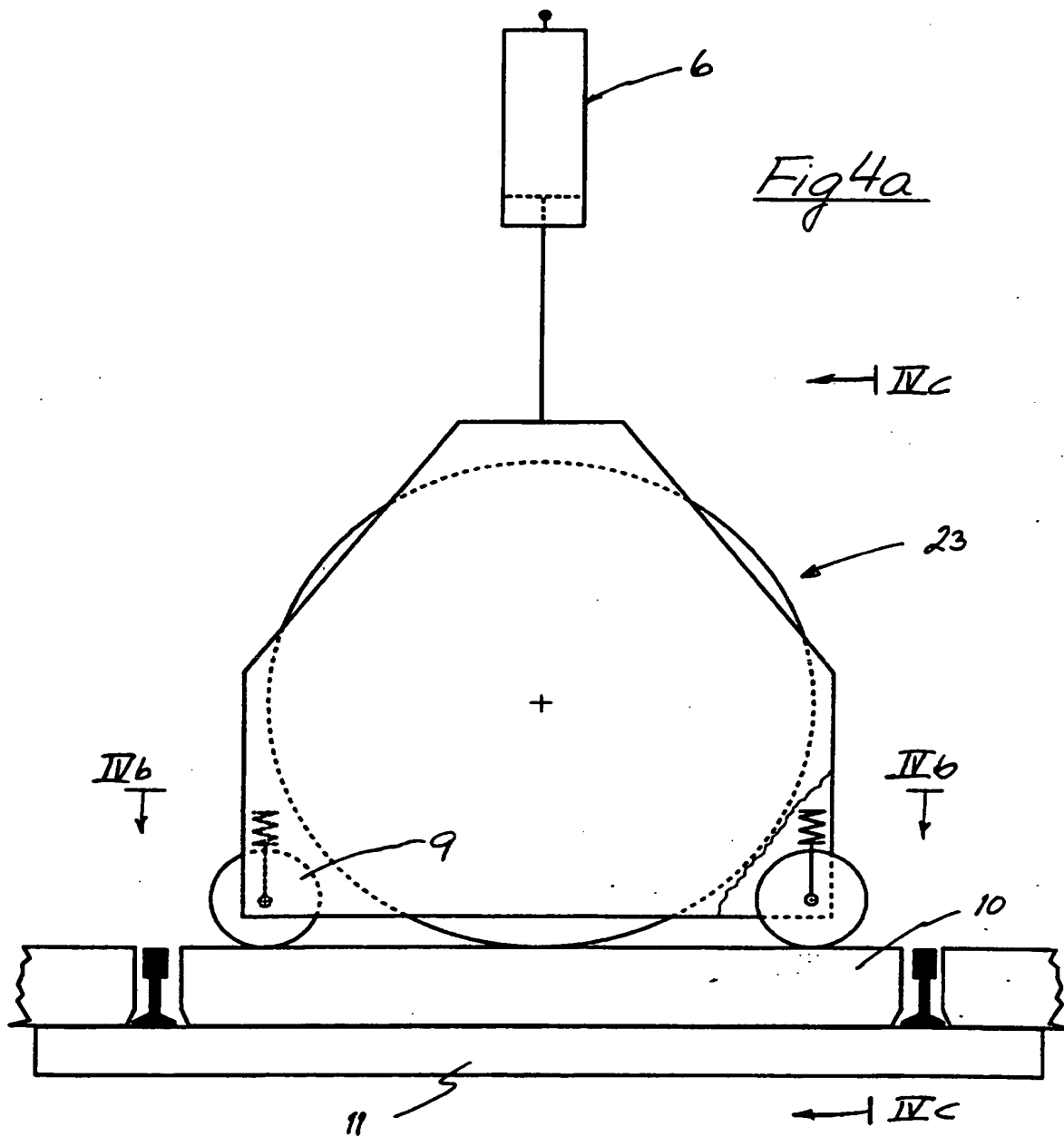
Fig 2a**SUBSTITUTE SHEET**

Fig 26







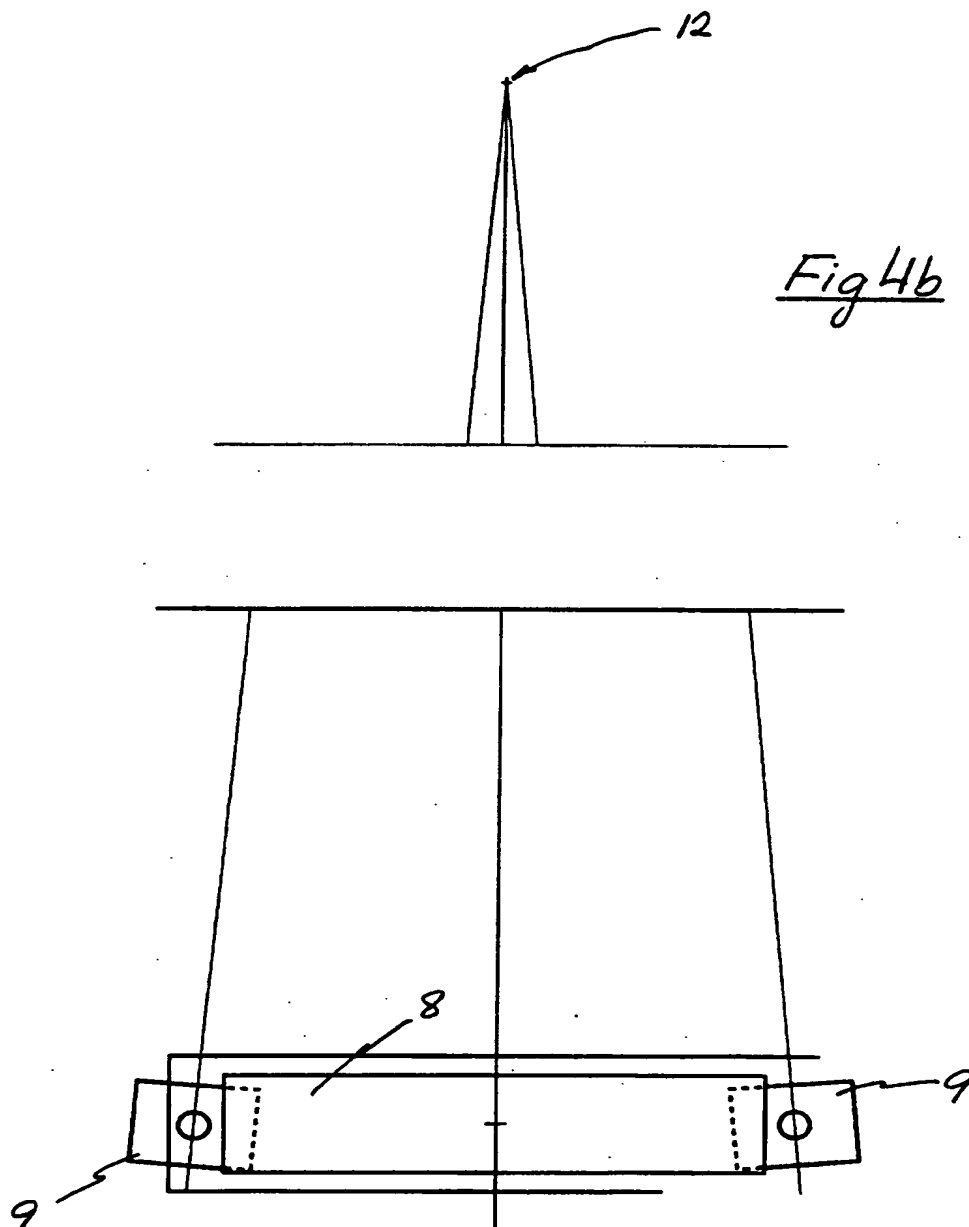
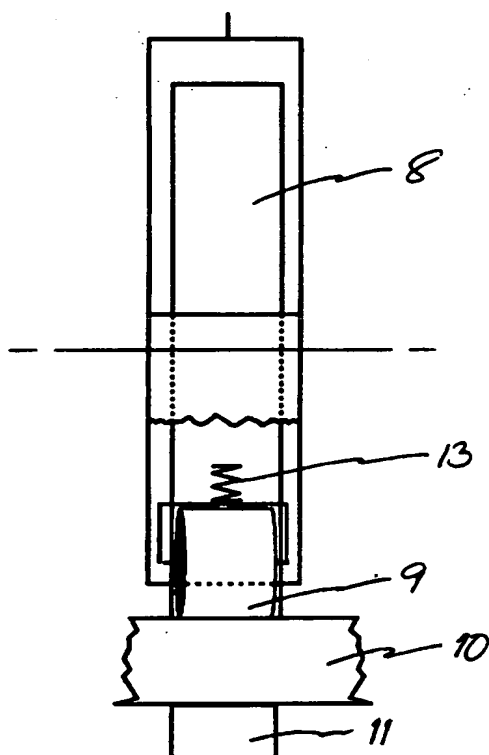
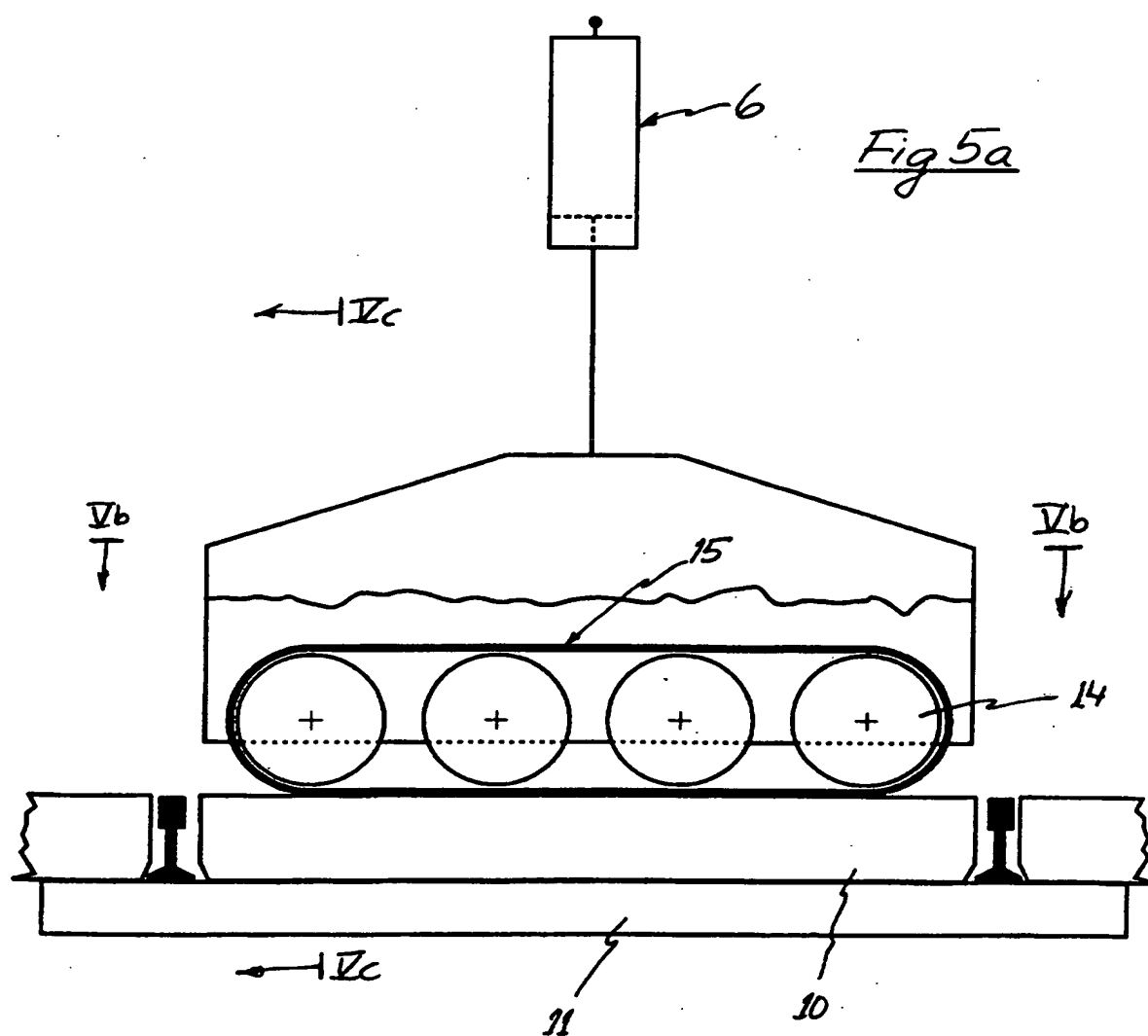


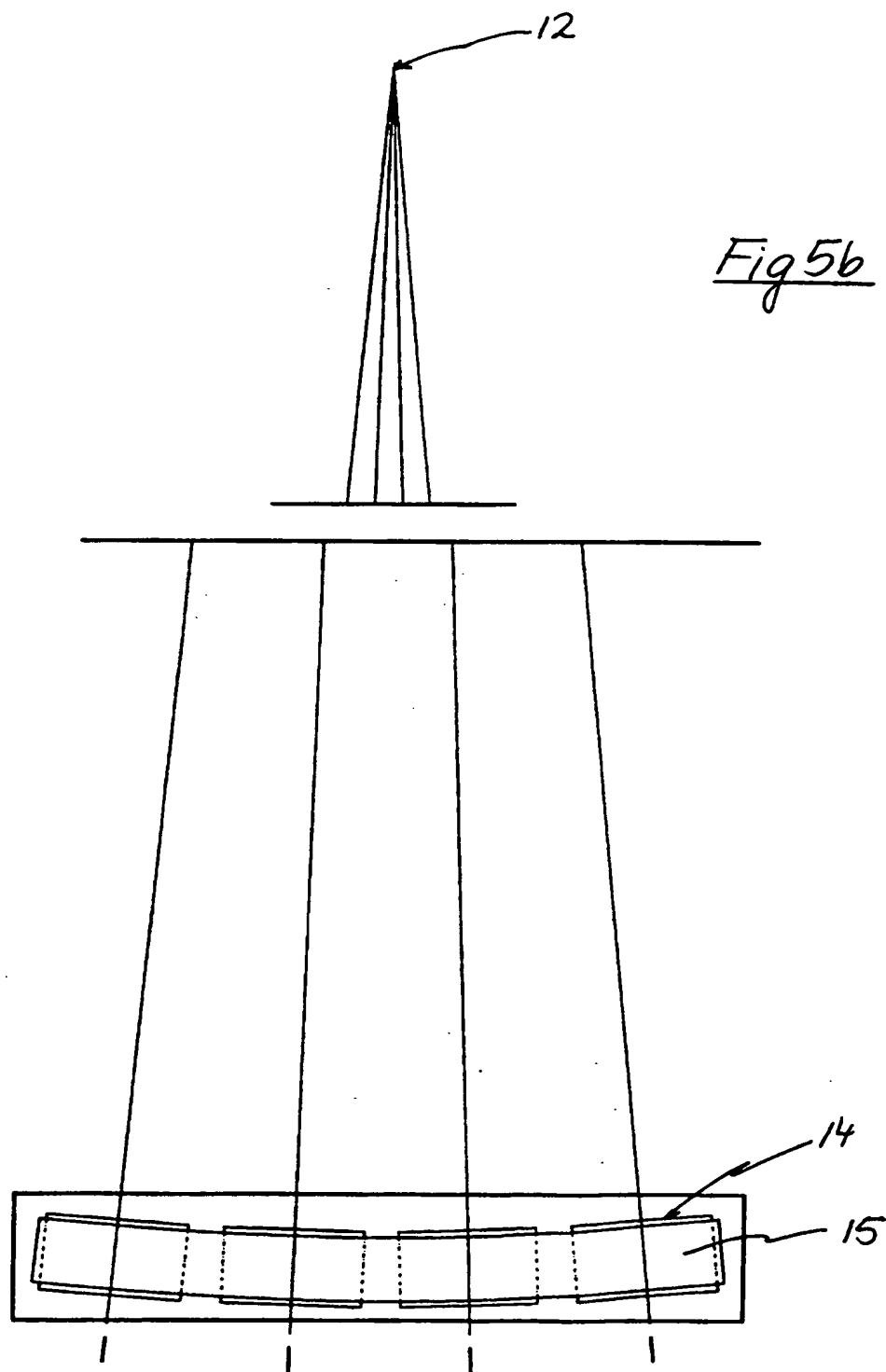
Fig 4c





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SUBSTITUTE SHEET

Fig 5c

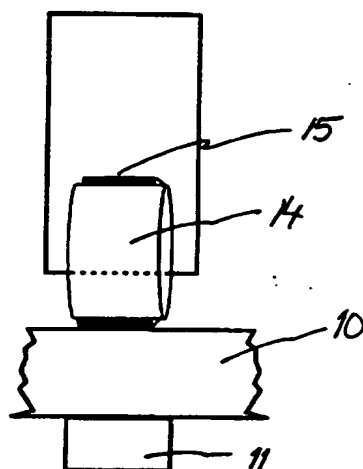
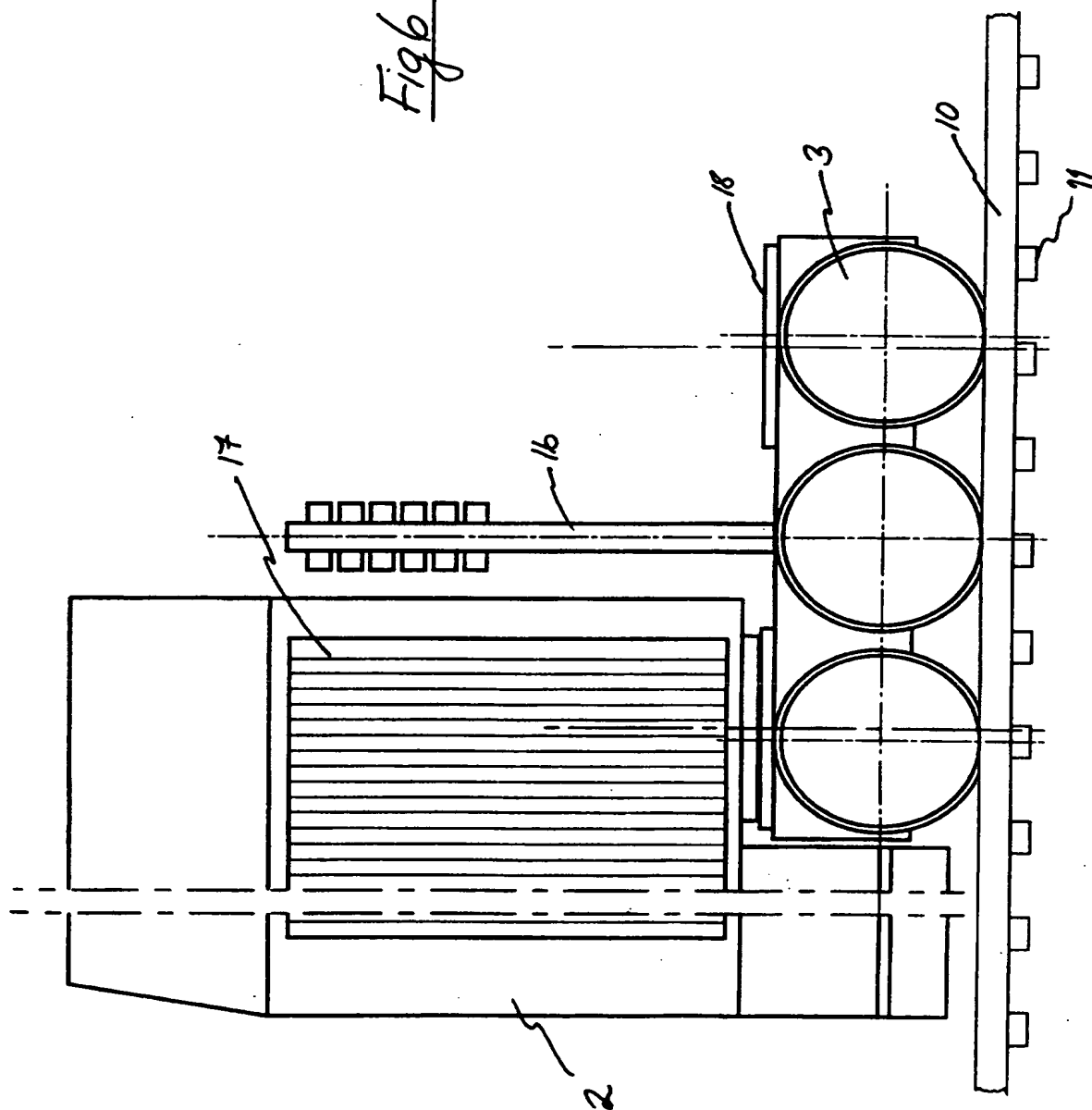


Fig 6



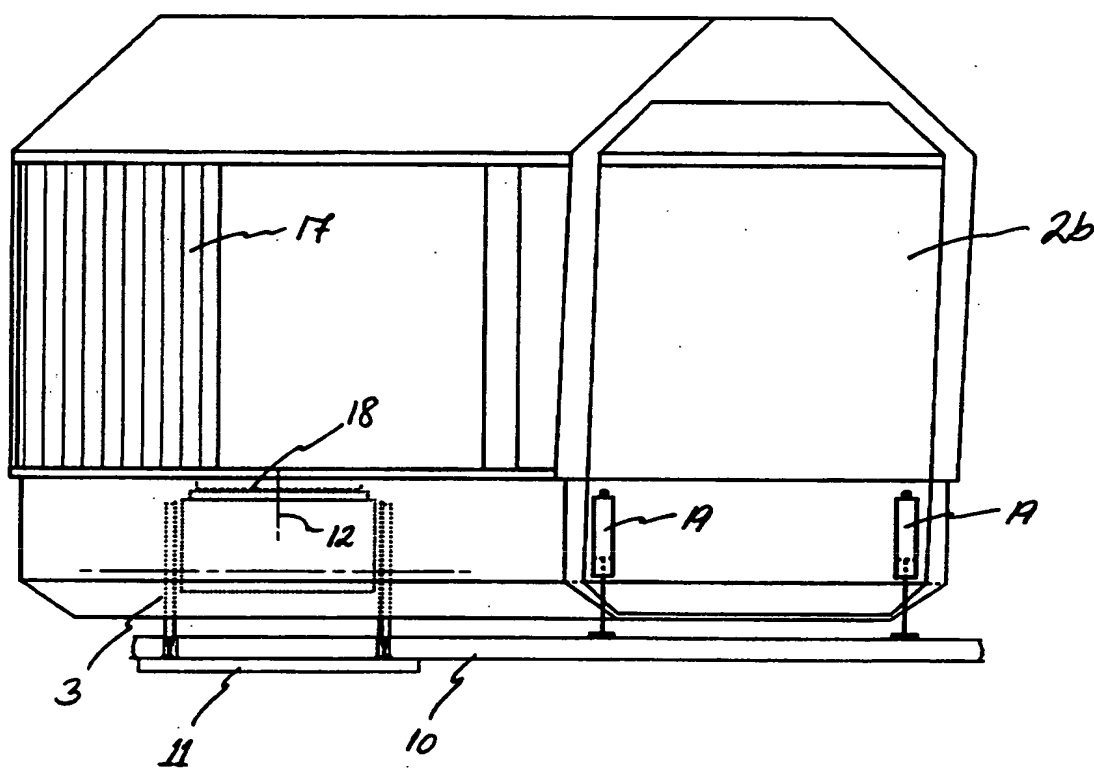
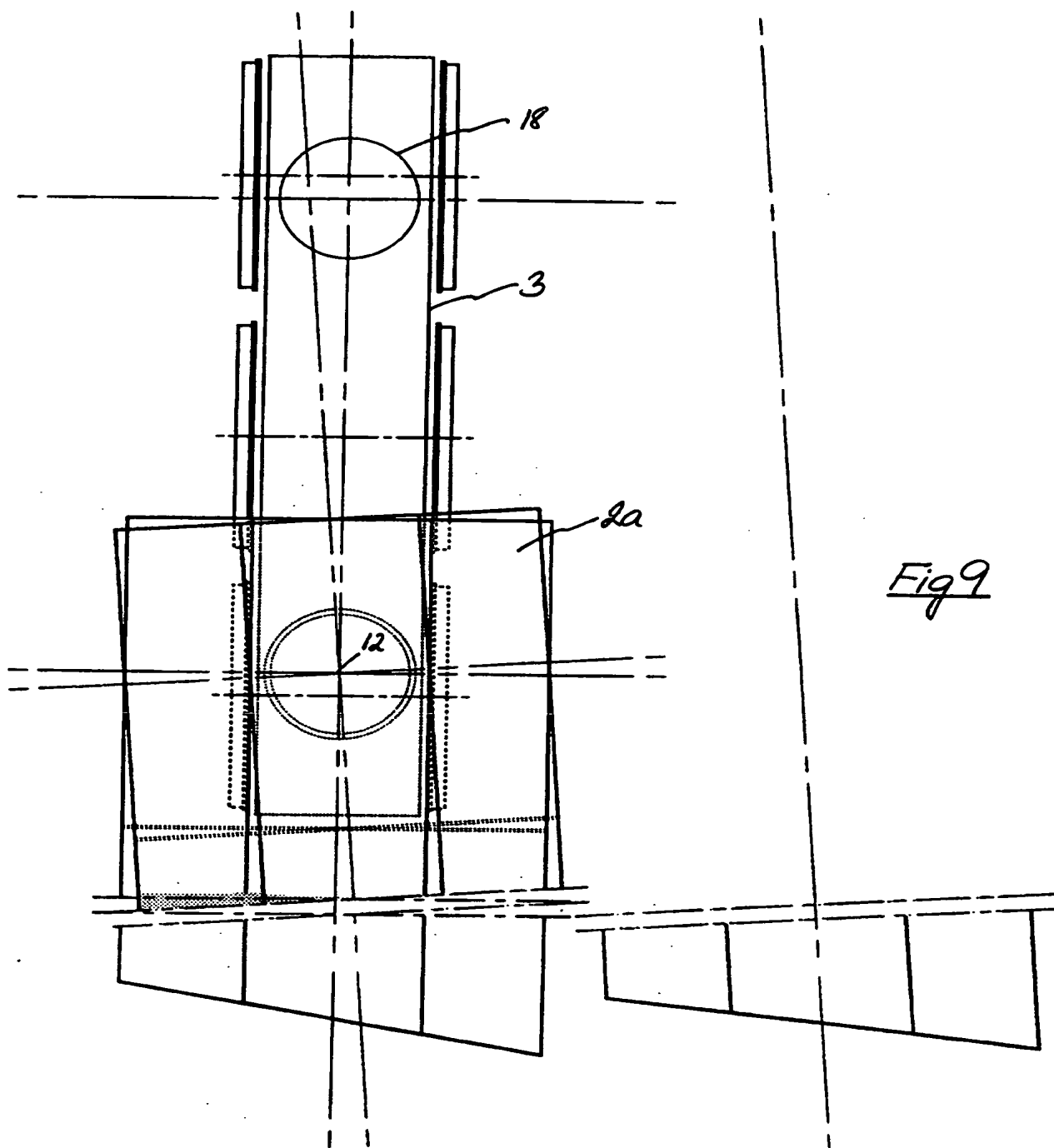


Fig 7



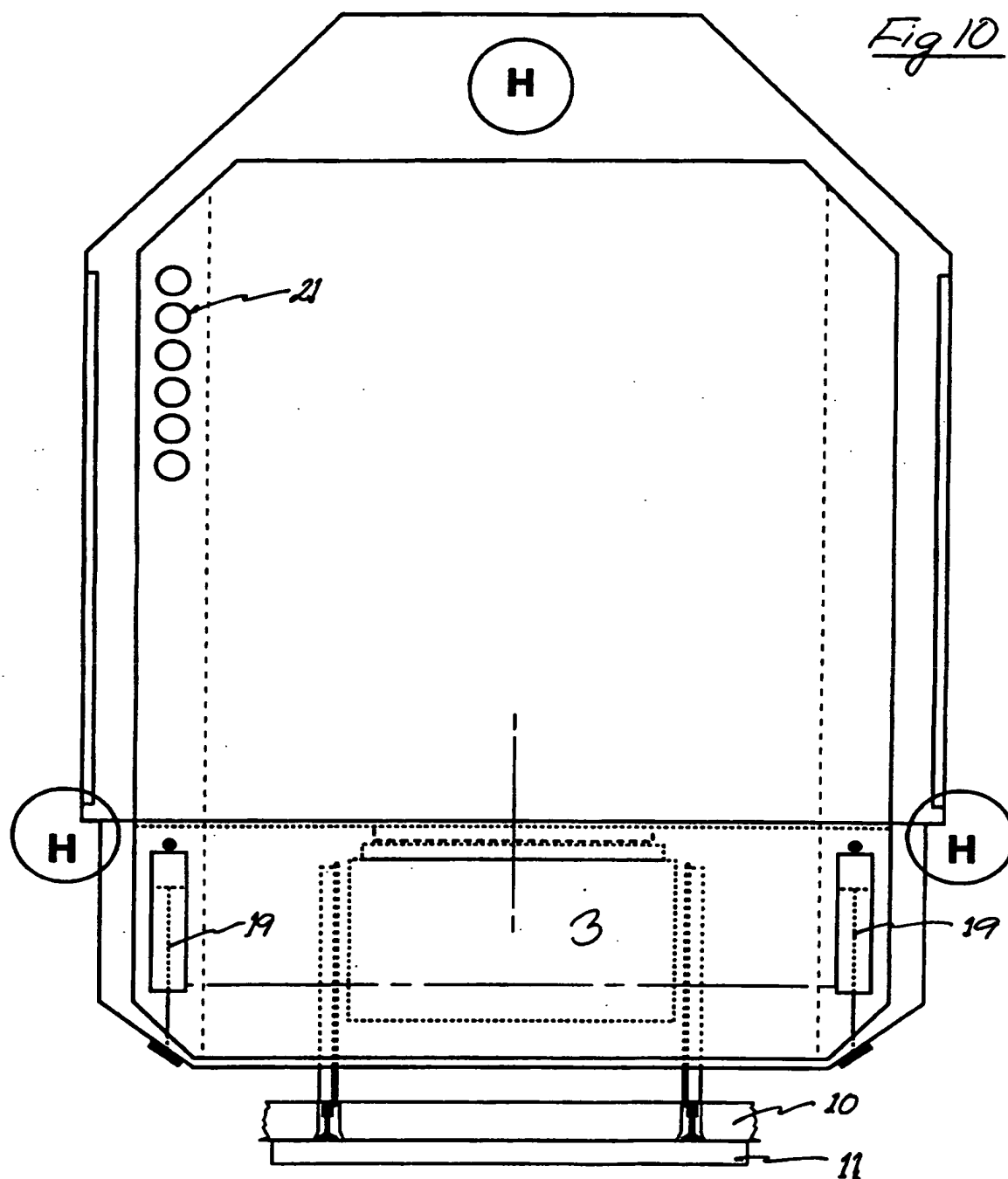


Fig 11

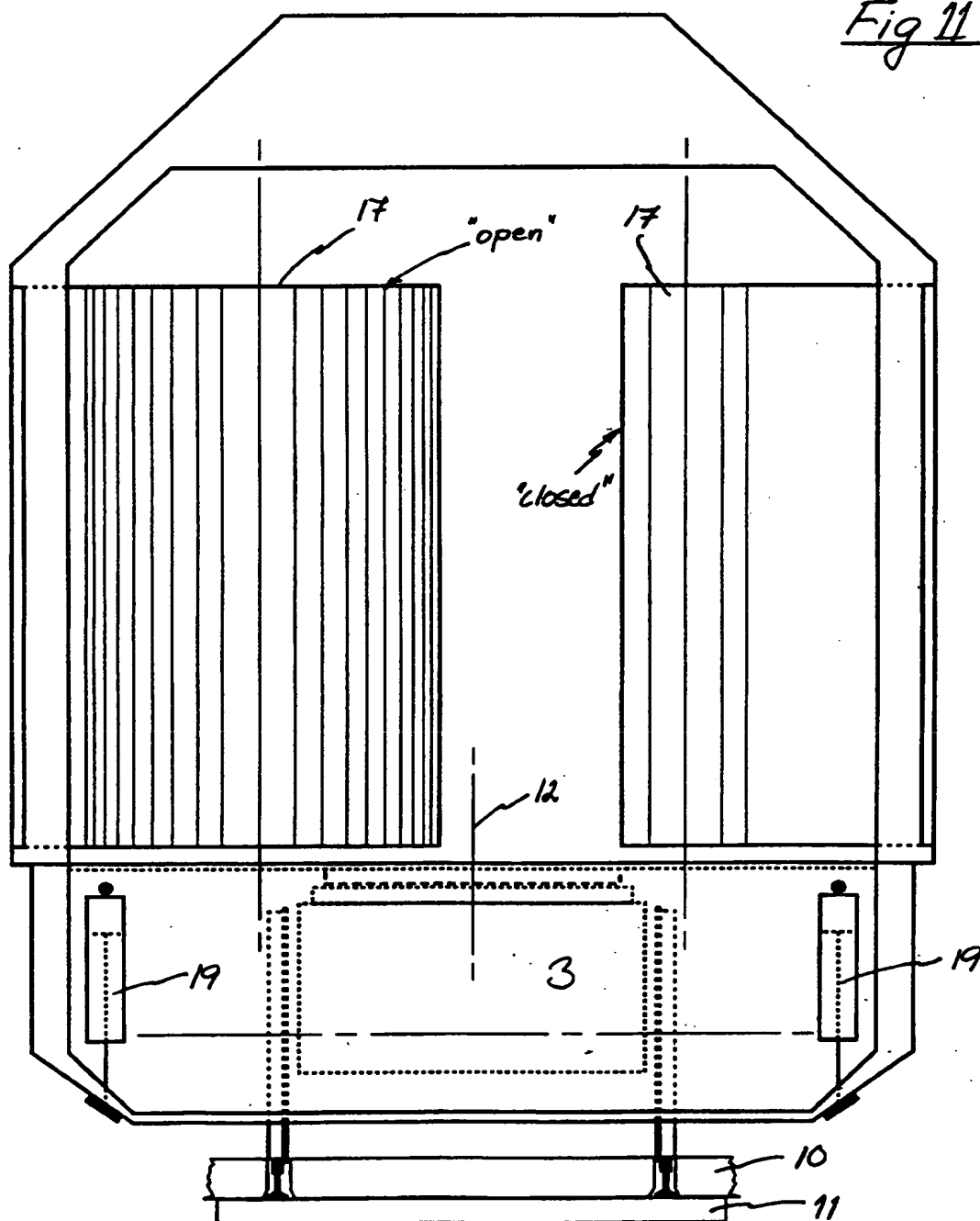


Fig 12a

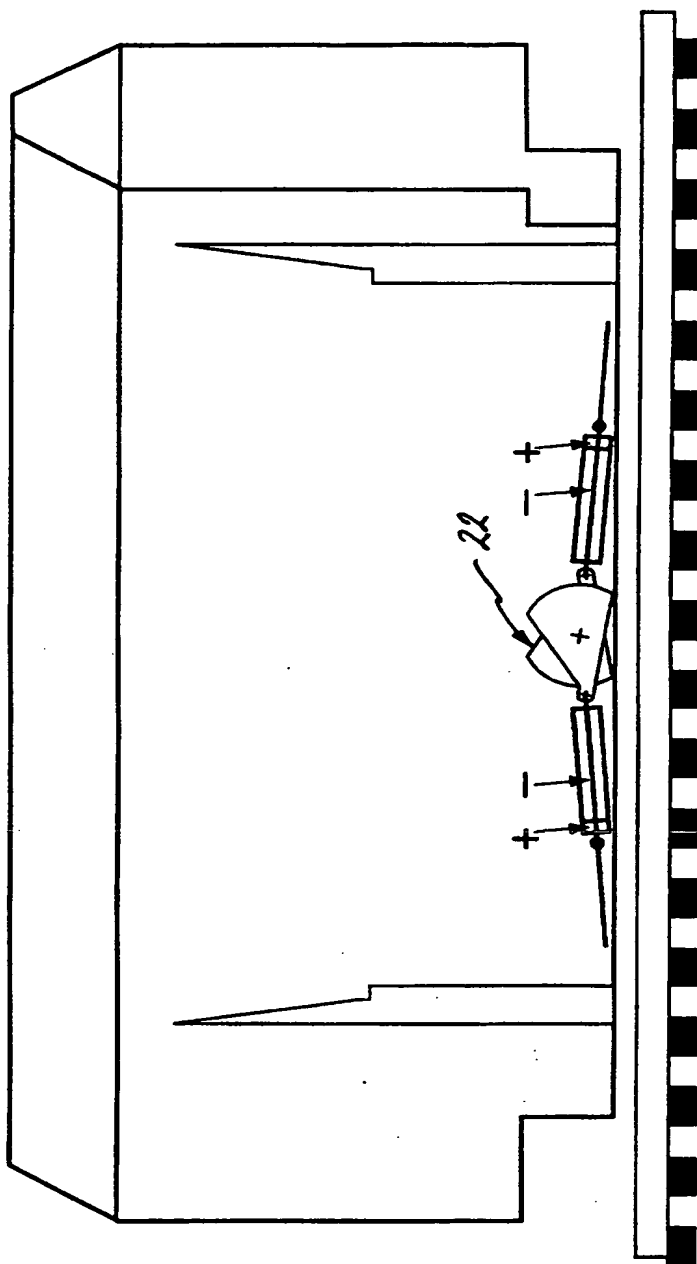
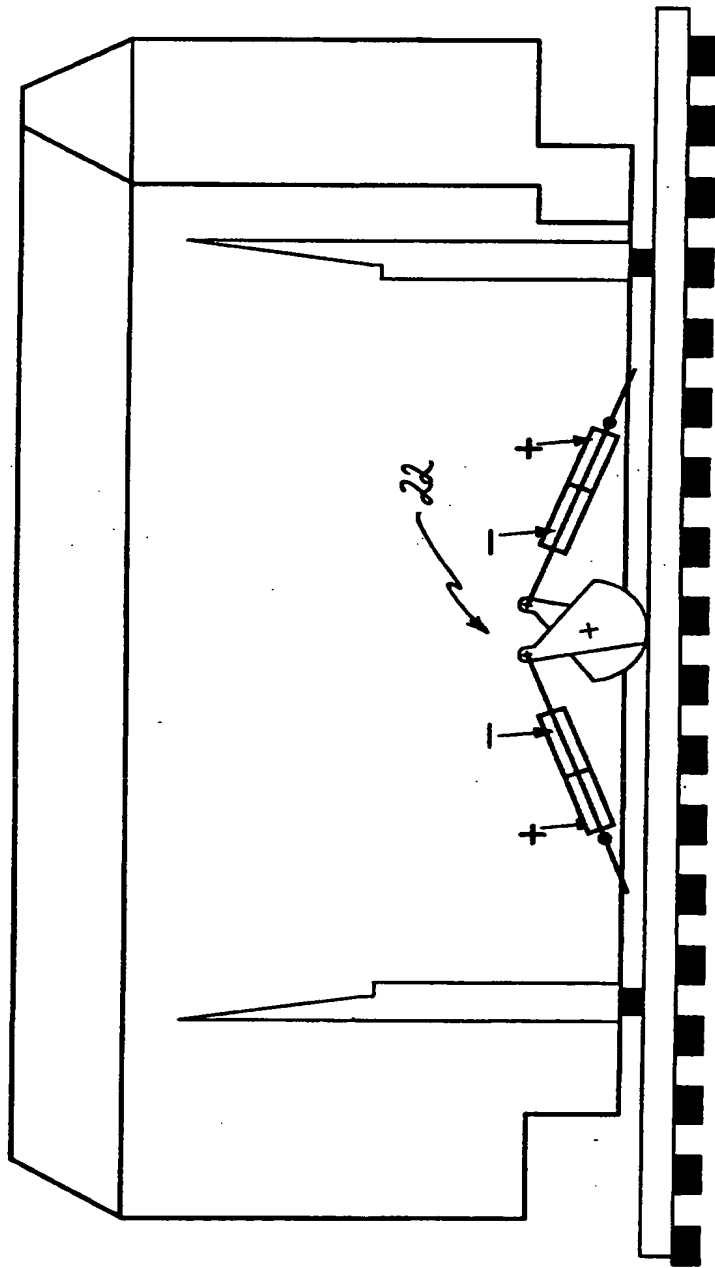


Fig 12b



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/01220

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B61D 3/18, B61D 47/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B61D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3234374 C2 (WAGGONFABRIK TALBOT), 22 March 1984 (22.03.84), column 4, line 2 - line 10, figures 2, 3,6 --	1-9
A	EP 0528741 A1 (LOHR INDUSTRIE), 24 February 1993 (24.02.93), column 13, line 50 - column 14, line 11, figures 23-25, 35 --	1-9
A	EP 0540132 A1 (WESTINGHOUSE-TRANSPORT-SYSTEME GMBH), 5 May 1993 (05.05.93), figures 1-3 --	1-9

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/01220

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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05/01/96

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